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DIRAC for CTA Report

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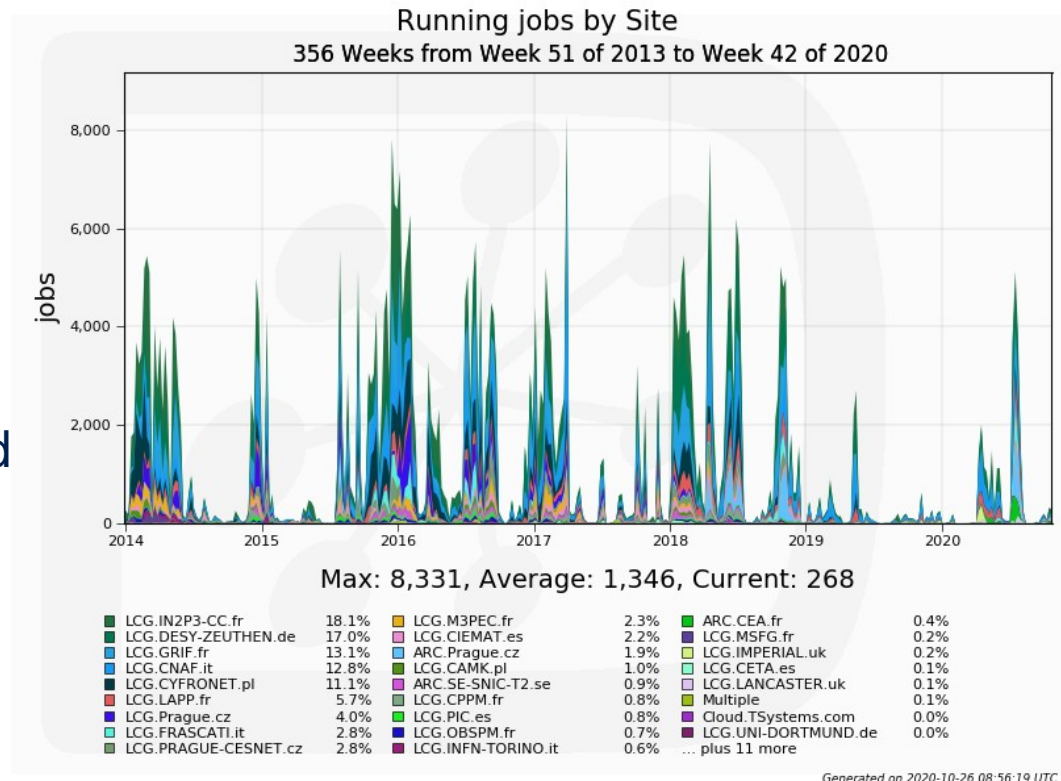
ESCAPE WP5 October 2020

Outline

- DIRAC for CTA - *CTADIRAC*
 - Resources available
 - Hardware setup
 - DIRAC functionalities in use
 - Workload Management system
 - Workflow handling
- In production ?
 - Thoughts and Plans

CTA Computing resources

- More than 15 sites across Europe
- More than 4 PB of disk on 6 sites
- More than 2 PB of tape on 3 sites
- Many different types of grid and non-grid storage and computing resources



~100 MHS06 consumed and several PB of data moved each year since 2014

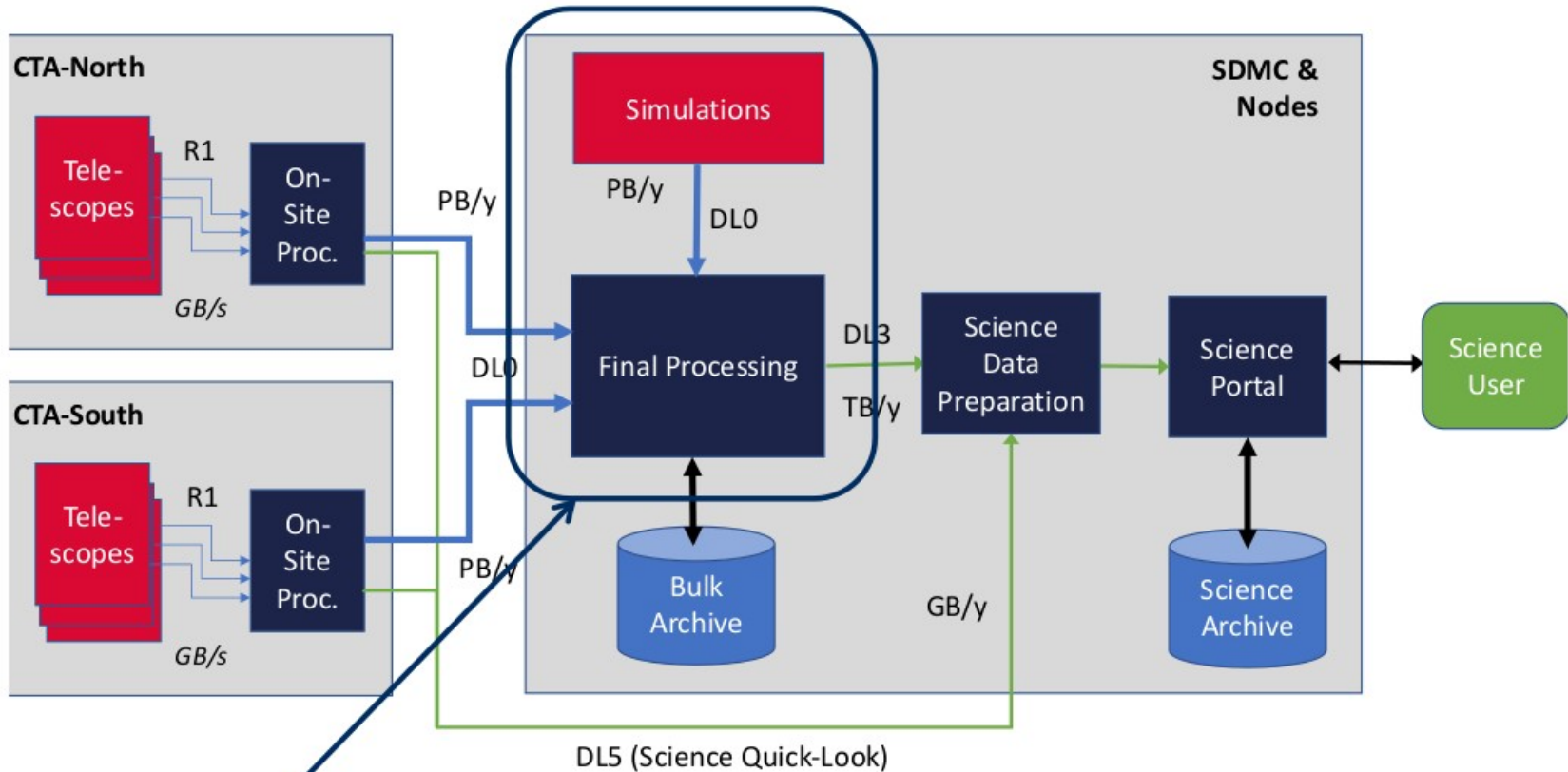
CTA-DIRAC hardware setup

- DIRAC instance dedicated to CTA distributed at 3 sites (CC-IN2P3, PIC, DESY)
- 5 core servers
 - 1 running WMS services (32 cores, 32 GB RAM)
 - 1 running WMS agents and executors (32 cores, 32 GB RAM)
 - 1 running TS and RMS (16 cores, 8GB RAM)
 - 1 running DMS + 1 DIRAC SE (16 cores, 8GB RAM, 2 TB of disk for the SE)
 - 1 running duplicated DMS, TS, RMS services (8 cores, 32 GB RAM)
- 2 MySQL servers (used as **services**)
 - 1 hosting FileCatalogDB, TransformationDB, ReqDB (dedicated server at CC-IN2P3)
 - 1 hosting all other DBs at PIC
- 1 server for the Web portal (at CC-IN2P3)
- 1 ElasticSearch server (ELK instance) at CC-IN2P3 (used as a **service**)
 - For accounting and monitoring (in development now for us)
- Installed DIRAC version v7r0p18 (soon upgrading to v7r1)
- + **CVMFS** for software distribution

DIRAC functionalities in use

- Accounting
- Data Management (**DMS**)
- DIRAC File Catalog (**DFC**)
 - Extensively used as replica and meta-data catalog
 - Using datasets for official productions
- Request Management (**RMS**)
 - For replication/removal (through TS)
 - For job failover
- **Transformation System (TS)**
 - For MC Simulation, data-processing
 - Data Management: bulk replication/removal
- **Production system prototype (PS)**
 - For MC Simulation, data-processing
- VMDIRAC
- COMDIRAC
- WebApp
- **Workload Management (WMS)**
 - Targeted resources: CREAM CE, ARC CE, HT-Condor, PBS cluster

Computing Resources and Workload Management System



CRWMS scope

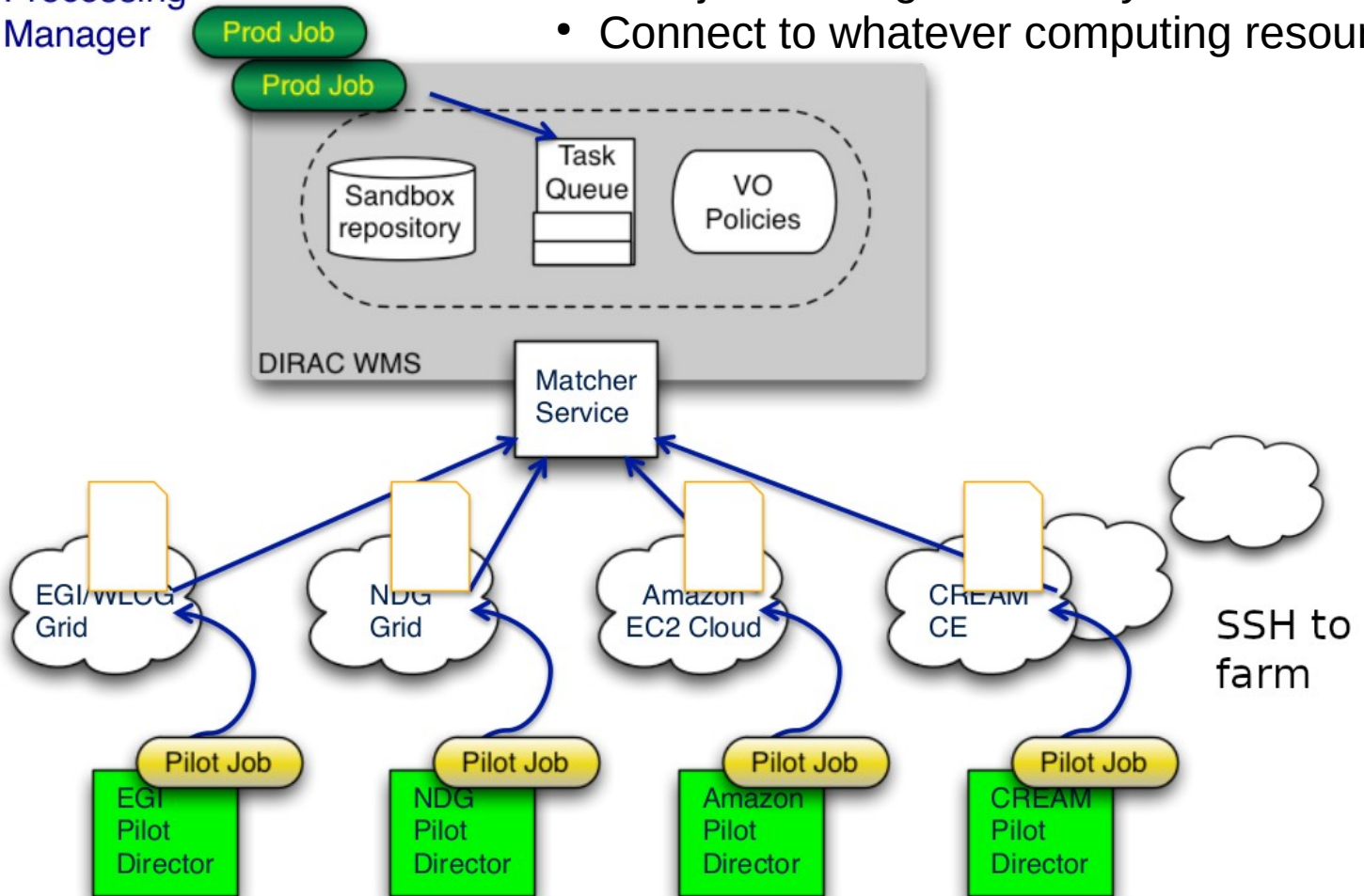
Workload Management

Vanilla DIRAC



Processing Manager

- Pilot jobs for high efficiency
- Connect to whatever computing resource



Data driven Workflow Management



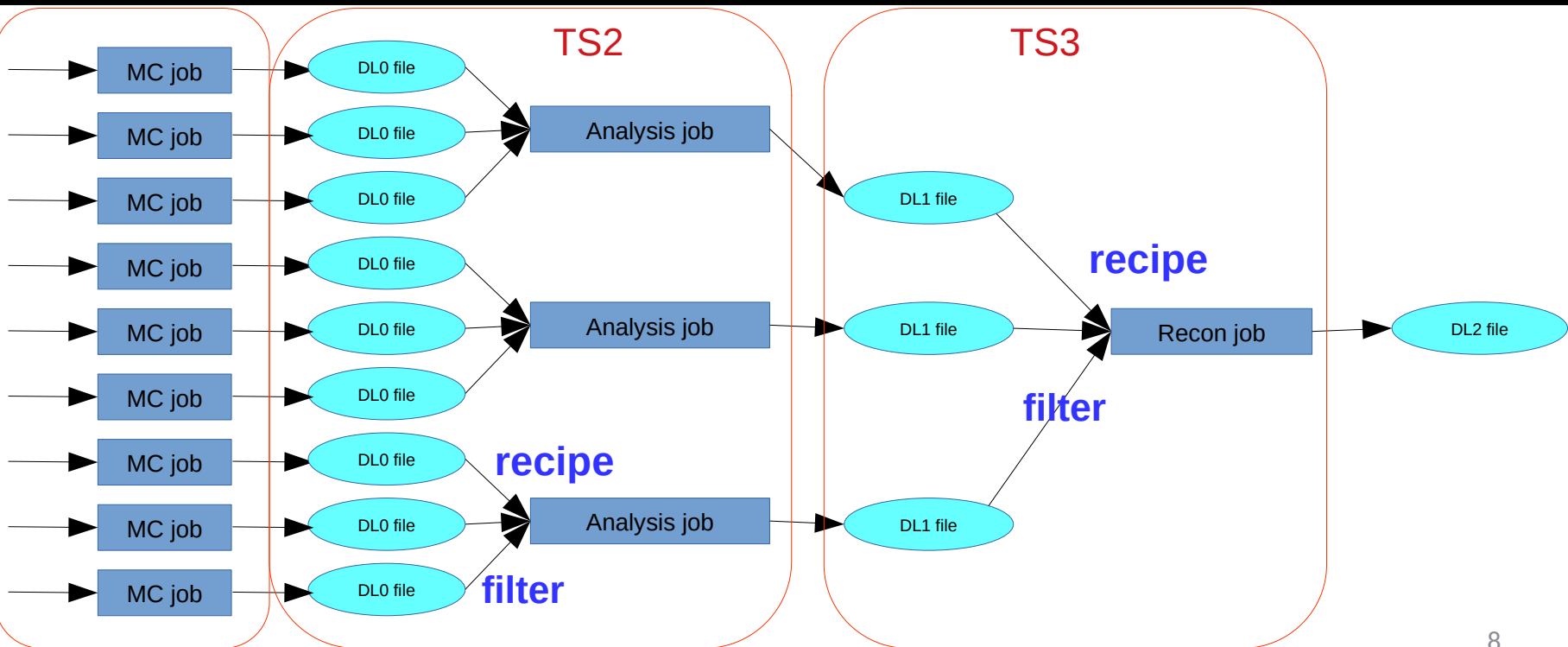
- Transformation System & Production System (our development)
 - Automated Tasks, workhorse for MC production and analysis
 - A **Transformation** is an input **data filter** + **a recipe** to create jobs
 - Fully data-driven: jobs are created as soon as data with required properties are registered into the **Dirac File Catalog**

Production

TS1

TS2

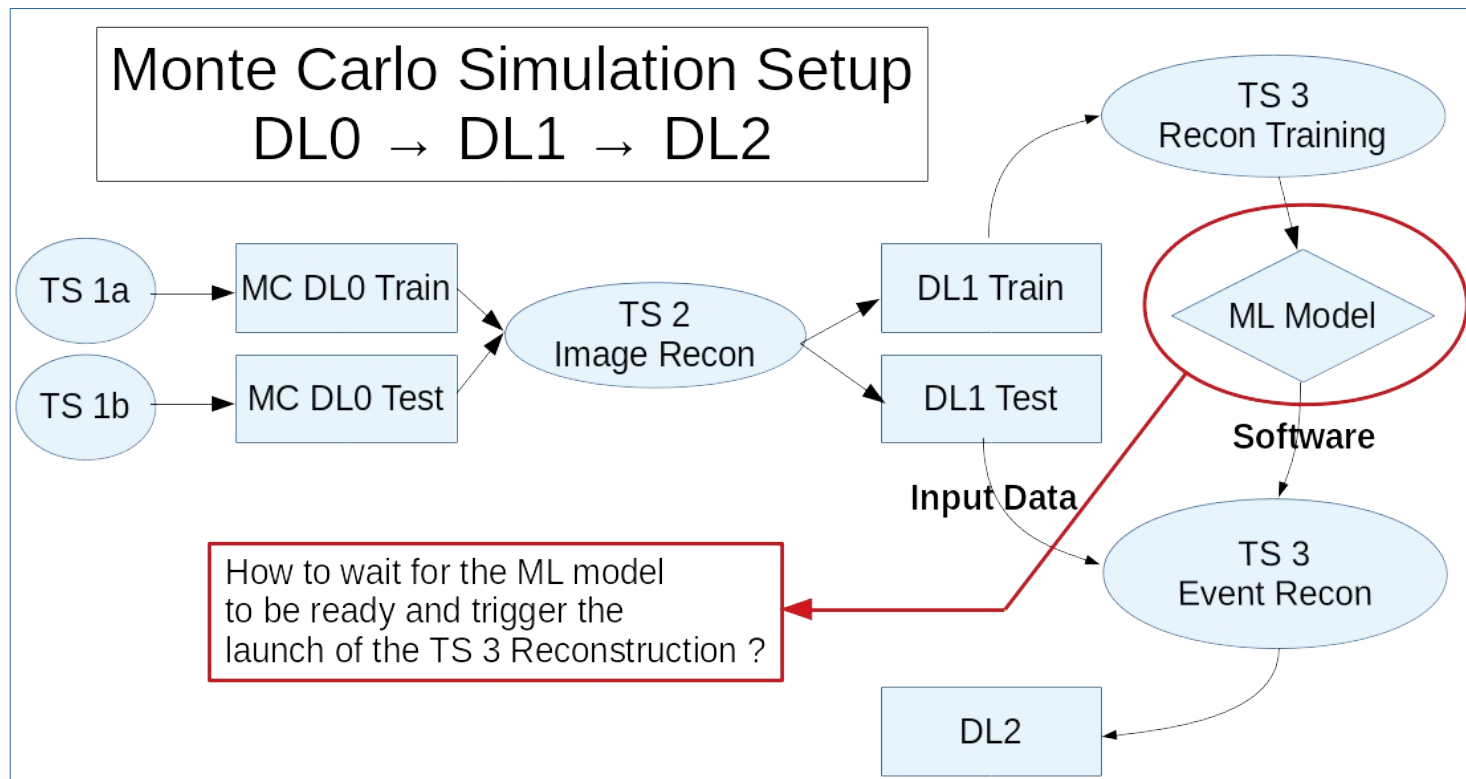
TS3



Split/Merge & Train/Test workflows

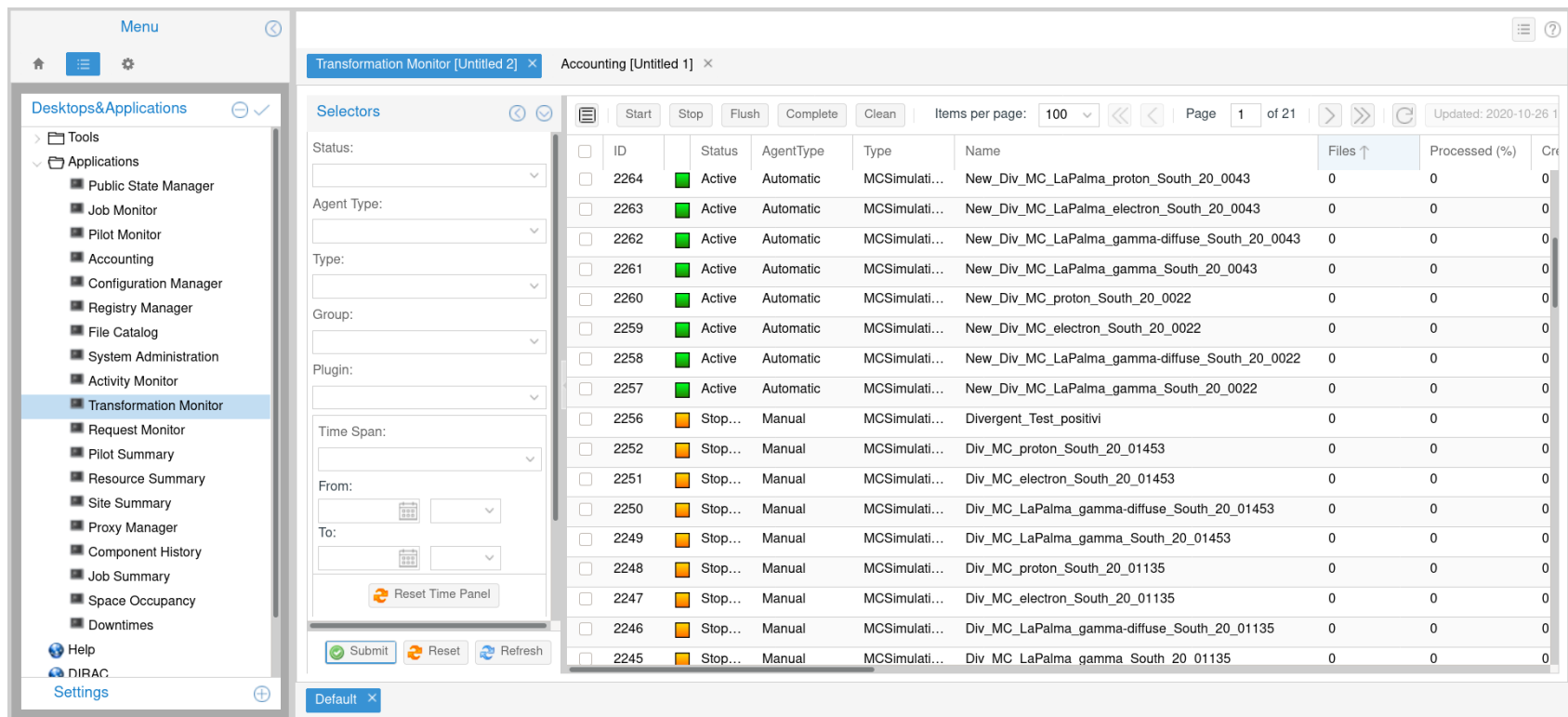


- How do we fully automatize this kind of workflow ?
 - Problem is that the look-up table/ML model/BDT are « part » of the software, how do we know that these are ready and that the next step can be run ?



How work is done

- DIRAC client with CTADIRAC plugin
- DIRAC base scripts and custom scripts
- Web interface



The screenshot displays the CTADIRAC web interface. On the left is a navigation menu with categories like 'Tools' and 'Applications'. The 'Transformation Monitor' application is selected. The main area shows a table of jobs with columns for ID, Status, AgentType, Type, Name, Files, and Processed (%). The table contains 17 rows of job data. Below the table are controls for filtering (Selectors), time span, and actions (Submit, Reset, Refresh).

ID	Status	AgentType	Type	Name	Files	Processed (%)
2264	Active	Automatic	MCSimulati...	New_Div_MC_LaPalma_proton_South_20_0043	0	0
2263	Active	Automatic	MCSimulati...	New_Div_MC_LaPalma_electron_South_20_0043	0	0
2262	Active	Automatic	MCSimulati...	New_Div_MC_LaPalma_gamma-diffuse_South_20_0043	0	0
2261	Active	Automatic	MCSimulati...	New_Div_MC_LaPalma_gamma_South_20_0043	0	0
2260	Active	Automatic	MCSimulati...	New_Div_MC_proton_South_20_0022	0	0
2259	Active	Automatic	MCSimulati...	New_Div_MC_electron_South_20_0022	0	0
2258	Active	Automatic	MCSimulati...	New_Div_MC_LaPalma_gamma-diffuse_South_20_0022	0	0
2257	Active	Automatic	MCSimulati...	New_Div_MC_LaPalma_gamma_South_20_0022	0	0
2256	Stop...	Manual	MCSimulati...	Divergent_Test_positivi	0	0
2252	Stop...	Manual	MCSimulati...	Div_MC_proton_South_20_01453	0	0
2251	Stop...	Manual	MCSimulati...	Div_MC_electron_South_20_01453	0	0
2250	Stop...	Manual	MCSimulati...	Div_MC_LaPalma_gamma-diffuse_South_20_01453	0	0
2249	Stop...	Manual	MCSimulati...	Div_MC_LaPalma_gamma_South_20_01453	0	0
2248	Stop...	Manual	MCSimulati...	Div_MC_proton_South_20_01135	0	0
2247	Stop...	Manual	MCSimulati...	Div_MC_electron_South_20_01135	0	0
2246	Stop...	Manual	MCSimulati...	Div_MC_LaPalma_gamma-diffuse_South_20_01135	0	0
2245	Stop...	Manual	MCSimulati...	Div MC LaPalma gamma South 20 01135	0	0



CTA-DIRAC extension

- Extension of the job API for « standard » CTA jobs
- Dedicated scripts for large scale production
- Software Manager to manage software available on cvmfs
- Data Manager to handle upload and register of data files with metadata to the Dirac File Catalog

cta-observatory / CTADIRAC

Unwatch 6 Star 2 Fork 5

<> Code Issues 2 Pull requests Actions Wiki Security Insights Settings

master 65 branches 318 tags

Go to file Add file Code

bregeon v1r60p0	014887a on Sep 9	🕒 1,500 commits
ConfigurationSystem	config for StorageMonitorAgent	8 months ago
Core	get run number for ctape DL1	2 months ago
DataManagementSystem	Execution part with internal keys	2 months ago
Interfaces	expect 1 file	2 months ago
WorkloadManagementSystem	add custom CTA commands	10 months ago
.gitignore	Add .idea in .gitignore	2 months ago
README.md	Update README.md	9 months ago
Singularity	update for v7	10 months ago

About

CTA-customized version of the DIRAC middleware

Readme

Releases 318

Update Provenance Service Latest
on Sep 2

+ 317 releases

Packages

No packages published
[Publish your first package](#)

How to hand this to the CTA Observatory ?



- Hardware setup will likely stay as is, and current instance kept on running
- Need to decide if to setup a clean instance from scratch or build on top of the existing one
- Need to train (at least) a few operators at CTAO to learn how to drive the thing : administration + production
 - Whatever we prepare, usage and technologies will evolve
 - CTAO shall have the minimal knowledge to adapt
 - « We » will keep on providing expertise for some time
 - Expertise is also available within the DIRAC consortium and forum
- Main UI could be either the DIRAC WebApp, customized or not, or minimum functionalities could be integrated to the CTAO GUI framework through REST interface

Conclusions

- DIRAC successfully used for CTA simulations for 8 years
 - dedicated instance with a set of servers and services distributed in 3 computing centers
- Use of the workload management to access all kind of available resources efficiently and smoothly
- Use of data driven workflow with the Transformation and Production systems
- Use of the Dirac File Catalog and Data Management system for data management, in close relation with the data driven workflow
- Needs limited man power **today** (<1 FTE) for simulations only
 - 2 people : 1 expert admin + 1 production and data manager
 - 25 % for administration and some core developments
 - 50 % for production, data management and user support